The eagle genus *Hieraaetus* is distinct from *Aquila*, with comments on the name Ayres' Eagle

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Consensus has long existed among taxonomists as to the placement of the species of the eagles in the genera *Aquila* and *Hieraaetus*, the only exception being Wahlberg's Eagle, which has been treated either as *A. wahlbergi* or *H. wahlbergi*. However, recent comparisons of DNA sequences of these eagles revealed that both genera were polyphyletic (Helbig *et al.* 2005, Lerner & Mindell 2005, Griffiths *et al.* 2007, Haring *et al.* 2007). To ensure monophyly, these authors recommended that some species be moved into and out of both genera and placed Wahlberg's Eagle definitely in *Hieraaetus*. On the other hand, Sangster *et al.* (2005) recommended that *Hieraaetus* be subsumed into *Aquila*, for which they cite eight recent phylogenetic studies, only four of them published in peer-reviewed journals (Roulin & Wink 2004, Bunce *et al.* 2005, Helbig *et al.* 2005, Lerner & Mindell 2005); all of which, nevertheless, retained *Hieraaetus*. Thus, none of the four peer-reviewed journal articles cited by Sangster *et al.* (2005) to justify placing *Hieraaetus* into *Aquila* actually recommended this. Further, Sangster *et al.* (2005) proposed only that Booted Eagle (*pennatus*) be included in *Aquila*, because their recommendations only considered European birds. The generic treatment of Sangster *et al.* (2005) was followed without comment by Gjershaug *et al.* (2009) in describing Weiske's or Pygmy Eagle (*weiskei*) as a species separate from Little Eagle *H. morphnoides*. Hockey *et al.* (2005) cited a non-peer-reviewed conference presentation, Wink & Sauer-Gürth (2000), for subsuming *Hieraaetus* into *Aquila*, but their conclusions were based on the original paraphyletic species.

Wells & Inskipp (2012) advocated moving the three spotted eagles (taxa *clanga*, *pomarina* and *hastata*) from *Aquila* into a new genus *Aquiloides*. They considered that the genus *Aquila* that contained the spotted eagles and the taxa formerly in *Hieraaetus* was too large, too unwieldy and too diverse. They argued that there are three distinct clades, *Aquila*, *Hieraaetus* and *Aquiloides*, and that these should be considered separate genera, with the genera *Lophaetus* and *Ictinaetus* in the same clade as the spotted eagles but treated as monotypic genera because of their divergences from the spotted eagles. Gregory & Dickinson (2012) reported that the genus name that should be used for the spotted eagles is *Clanga*, based on priority.

Brown & Amadon (1968) wrote 'Some recent authors have combined *Hieraaetus* with *Aquila*, but it seems best to keep it separate on the following ensemble of characters, which admittedly do not hold for every species: size smaller, form more slender, bill smaller, legs longer, more slender, emargination on primaries deeper.'

In Table 1, I enumerate those characters that separate the species in the revamped genera *Hieraaetus* and *Aquila*. I include characters not mentioned by Brown & Amadon (1968), but that are important in distinguishing the members of these genera: (1) immature plumages almost like those of adults, (2) hunting primarily aerial, (3) lack of pale primary patch, (4) long narrow tail and (5) polymorphism. I believe that the degree of emargination of the primaries is not a distinguishing character because there is overlap (pers. obs.). Some species in the revamped genus possess characters not shared by all species, such as the white headlights of Booted and Ayres' Eagles and the crests of Wahlberg's and Ayres' Eagles.

TABLE 1
Differences in characters of eagles in the genera *Hieraaetus* and *Aquila*. Species are listed in Table 2.

Character	*Hieraaetus*	*Aquila*
Size	Small	Medium to large
Immature plumages	Almost like adult	Differ from adult
Hunting style	Primarily aerial	Still and aerial
Pale primary patch	No	Yes
Long narrow tail	Yes	Long on some, but broad
Colour morphs	Dimorphic or polymorphic	Monomorphic, except *rapax*

TABLE 2
Recommended classification of the genera *Hieraaetus* and *Aquila*. * = Type species of genus.

Steppe Eagle *Aquila nipalensis*
Eastern Imperial Eagle *A. heliaca*
Spanish Imperial Eagle *A. adalberti*
Tawny Eagle *A. rapax*
Golden Eagle *A. chrysaetos**
African Black Eagle *A. verreauxii*
Wedge-tailed Eagle *A. audax*
Gurney's Eagle *A. gurneyi*
Bonelli's Eagle *A. fasciata*
African Hawk-Eagle *A. spilogaster*
Cassin's Hawk-Eagle *A. africana*

Wahlberg's Eagle *Hieraaetus wahlbergi*
Ayres' Eagle *H. ayresii*
Booted Eagle *H. pennatus**
Little Eagle *H. morphnoides*
Pygmy Eagle *H. weiskei*

With *fasciatus* and *spilogaster* removed from *Hieraaetus* and placed in *Aquila*, and with *kienerii* removed to the monotypic genus *Lophotriorchis*, as recommended by both Helbig *et al.* (2005) and Lerner & Mindell (2005), the characters now hold for all species presently included in *Hieraaetus* and *Aquila* (Table 2).

Roulin & Wink (2004) evaluated raptors taxonomically by whether they are monomorphic or polymorphic. They listed three members of present-day *Hieraaetus* as polymorphic, but Bonelli's Eagle as monomorphic. The latter is now included in *Aquila*, as advocated by Lerner & Mindell (2005) and Helbig *et al.* (2005), and the other two taxa in the revamped *Hieraaetus* are also polymorphic, thus the results of Roulin & Wink (2004) are consistent with retention of *Hieraaetus*.

Debus *et al.* (2007b), in discussing the breeding biology of Little Eagle *H. morphnoides*, stated 'The results of this study and that on the Wedge-tailed Eagle (Debus *et al.* 2007a) lend some support to the separation of the genera *Hieraaetus* and *Aquila*, in the revised sense (following Helbig *et al.* 2005 and Lerner & Mindell 2005).' Further, Debus (2011) concluded 'Pair 3 provided an even greater contrast with the Wedge-tailed Eagle, in terms of parental sex-roles, than did the other Little Eagle pairs in 2006–2008 (*cf.* Debus *et al.* 2007a, b). Thus behavioural and other differences support the continued recognition of the two genera (*Aquila* and *Hieraaetus*), although internationally they tend now to be combined (e.g. Gjershaug *et al.* 2009).'

Bunce *et al.* (2005) analysed the mt DNA of an extinct large eagle from New Zealand and concluded that it was closer to species in *Hieraaetus* than those in *Aquila*. They theorised that this large eagle evolved from a small *Hieraaetus* in Australia or Asia. Their results provide yet another indication that *Aquila* and *Hieraaetus* are different.

Ayres' Eagle. It seems strange that *H. ayresii* has been called Ayres' Hawk-Eagle, the only one of the revamped genus to be so named. The name 'Hawk-Eagle' refers primarily

to slender, long-tailed, feathered-tarsi eagles that hunt inside forests in the manner of overgrown goshawks, such as the various members of the Old World genus *Nisaetus* (formerly *Spizaetus*, which is now restricted to four Neotropical species (Helbig *et al.* 2005) but also for two African raptors, African Hawk-Eagle *Aquila spilogaster* and Cassin's Hawk-Eagle *A. africanus*. These hawk-eagles have fairly short broad wings and long tails suitable for hunting inside forests, whereas Ayres' Eagle has rather narrower and longer wings, and a relatively shorter tail. Ayres' is an aerial hunter in the manner of Booted and Little Eagles, and shares few characters with true hawk-eagles, which hunt primarily inside forests. For consistency of nomenclature, it should be called simply 'Ayres' Eagle', as was done many years ago by Roberts (1940).

Conclusion. Herein I present rationale for retaining the genus *Hieraaetus*. I also dispute that any of the references cited by Sanger *et al.* (2005) justify moving this genus into *Aquila* and further dispute that the results of Wink & Sauer-Gürth (2000) justified such inclusion. Both *Aquila* and *Hieraaetus*, as presently constituted (Table 2), are monophyletic and sister taxa (Helbig *et al.* 2005, Lerner & Mindell 2005, supported by Griffiths *et al.* 2007, Haring *et al.* 2007), with the spotted eagles placed in their own genus *Clanga*, which is also monophyletic but forms a clade with the somewhat morphologically different *Lophaetus* and *Ictinaetus* (Wells & Inskipp 2012). Wells & Inskipp (2012) wrote 'A further advantage of this smaller genus approach is that it facilitates retention of the name *Hieraaetus*.' Note that all DNA-based studies have retained *Hieraaetus* as a distinct genus (e.g., Griffiths *et al.* 2007, Haring *et al.* 2007).

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